The X-ray flaring emission from High Mass X-ray Binaries: the effects of wind inhomogeneities

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Abstract

We have developed a clumpy stellar wind model for OB supergiants in order to compare predictions of this model with the X-ray behaviour of both classes of persistent and transient High Mass X-ray Binaries (HMXBs).

1 Introduction

The Galactic plane survey performed by *INTEGRAL* satellite in the last 7 years allowed the discovery of a new class of HMXBs with OB supergiants, called *Supergiant Fast X-ray Transients* (SFXTs): they are transient sources which sporadically exhibit flares, with duration of a few hours, reaching luminosity of $10^{36} - 10^{37}$ erg s^{-1}, and a high dynamic range, spanning 3 to 5 orders of magnitude [1]. The accretion mechanism responsible for the peculiar SFXT behaviour is still not clear (see [2] and references therein for a recent review). Among the different possible explanations, [3] proposed that the SFXTs flares are produced by the accretion of dense blobs of matter from the companion wind.

2 A new clumpy stellar wind model

Since the accretion of one single clump of matter cannot explain the observed X-ray lightcurve in SFXTs in outburst (see e.g. [4, 5]), we developed a more detailed clumpy stellar wind model for OB supergiants in HMXBs [6]. For the first time, a mass and radius distributions for the clumps have been introduced. We assume for the clump the same velocity law of a smooth stellar wind, as suggested by [7], and following [8], we find that the clump size increases with the distance from the supergiant star [6]. For each mass of the clump, we derived the upper and lower-limits for the clump radius. We also modified the Bondi-Hoyle accretion model to take into account the presence of inhomogeneities in the wind. In this way, we were able to compare the observerd lightcurves of SFXTs and of persistent HMXBs with the calculated ones. We found that the observational characteristics of the flares, luminosity, duration, number of flares produced, do not depend only on the orbital parameters, but are also significantly affected by the properties of the clumps [6]. This model has been successfully applied to four HMXBs: Vela X−1, 4U 1700−37, IGR J18483−0311 and IGR J11215−5952 [6, 9].

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